[0046]   We claim:

1.   A computer implemented method of encoding video images, where each image has a frame type, comprising:

receiving a plurality of macroblocks for an uncompressed image;

determining a macroblock type for each macroblock;

determining whether the image represents a scene change from a distribution of macroblock types of the macroblocks; and

encoding the image in response to the determination of a scene change and the type of the frame.

2.   The method of claim 1, wherein determining whether the image represents a scene change, comprises:

identifying the scene change in response to a percentage of prediction macroblocks in the image.

3.   The method of claim 1, wherein determining whether the image represents a scene change, comprises:

responsive to the image being a forward predicted frame type, determining a percentage of intra-encoded macroblocks; and

responsive to the percentage of intra-encoded macroblocks, identifying a scene change at the image.

4.   The method of claim 3, further comprising:

responsive to the percentage of intra-encoded macroblocks exceeding a threshold, identifying a scene change at the image.

5.   The method of claim 4, wherein the threshold is about .65.

6.   The method of claim 1, wherein determining whether the image represents a scene change, comprises:

>   responsive to the image being a bidirectionally predicted frame type, determining a percentage of backward predicted macroblocks; and

>   responsive to the percentage of backward predicted macroblocks, identifying a scene change at the image.

7.   The method of claim 6, further comprising:

>   responsive to the percentage of backward predicted macroblocks exceeding a threshold, identifying a scene change at the image.

8.   The method of claim 7, wherein the threshold is about .70.

9.   The method of claim 1, wherein determining whether the image represents a scene change, comprises:

>   responsive to the image being a bidirectionally predicted frame type, determining a percentage of forward predicted macroblocks; and

>   responsive to the percentage of forward predicted macroblocks, identifying a scene change at the image.

10.   The method of claim 6, further comprising:

>   responsive to the percentage of forward predicted macroblocks exceeding a threshold, identifying a scene change at the image.

11.   The method of claim 7, wherein the threshold is about .70.

12.   The method of claim 1, wherein determining whether the image represents a scene change, comprises:

>   responsive to the image being a forward predicted frame type, determining a percentage of intra-encoded macroblocks;

>   responsive to the image being a bidirectionally predicted frame type, determining a percentage of backward predicted macroblocks;

responsive to the image being a bidirectionally predicted frame type, determining a percentage of forward predicted macroblocks; and

responsive to a determined percentage exceeding a threshold corresponding to the type of macroblock, identifying the image as a scene change.

13. The method of claim 1, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises increasing a number of bits used to encode the image, without changing the frame type of the image.

14. The method of claim 1, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises changing a quantization rate used to quantize the image, without changing the frame type of the image.

15. The method of claim 1, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises temporarily increasing a counter of a number of bits available for encoding a remaining set of images in a group of images containing the uncompressed image.

16. The method of claim 1, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises temporarily increasing a counter of a number of bits allocated to images having a same frame type as the frame type of the uncompressed image, in a group of images including the uncompressed image.

17. The method of claim 1, further comprising:
responsive to determining a scene change, generating data identifying the uncompressed image as corresponding to a scene change, and storing the generated data in a side information file for transmission or storage.

18.   A computer system for encoding video images, comprising:

a motion estimator adapted to receive a plurality of macroblocks for an uncompressed video image, the image having a frame type, and to determine macroblocks types for the macroblocks;

a scene change detector coupled to the motion estimator and adapted to determine whether the image represents a scene change from a distribution of the macroblock types of the image macroblocks; and

a quantizer coupled to the scene change detector for encoding the image in response to the determination of a scene change by the scene change detector and the type of the frame.

19.   The system of claim 18, wherein the scene change detector determines whether the image represents a scene change as a function of a percentage of prediction macroblocks in the image.

20.   The system of claim 18, wherein the scene change detector determines whether the image represents a scene change by determining a percentage of intra-encoded macroblocks in response to the image being a forward predicted frame type.

21.   The system of claim 20, wherein the scene change detector determines the scene change in response to the percentage of intra-encoded macroblocks exceeding a threshold.

22.   The system of claim 21, wherein the threshold is about .65.

23.   The system of claim 18, wherein the scene change detector determines whether the image represents a scene change by determining a percentage of backward predicted macroblocks in response to the image being a bidirectionally predicted frame type.

24.   The system of claim 23, wherein the scene change detector determines the scene change in response to the percentage of backward predicted macroblocks exceeding a threshold.

25.   The system of claim 24, wherein the threshold is about .70.

26.   The system of claim 18, wherein the scene change detector determines whether the image represents a scene change by determining a percentage of forward predicted macroblocks in response to the image being a bidirectionally predicted frame type.

27.   The system of claim 26, wherein the scene change detector determines the scene change in response to the percentage of forward predicted macroblocks exceeding a threshold.

28.   The system of claim 27, wherein the threshold is about .70.

29.   The system of claim 18, wherein the scene change detector determines whether the image represents a scene change by:
        determining a percentage of intra-encoded macroblocks in response to the image being a forward predicted frame type;
        determining a percentage of backward predicted macroblocks in response to the image being a bidirectionally predicted frame type;
        determining a percentage of forward predicted macroblocks in response to the image being a bidirectionally predicted frame type; and
        responsive to a determined percentage exceeding a threshold corresponding to the type of macroblock, identifying the image as a scene change.

30.   The system of claim 18, wherein the quantizer encodes the image in response to the determination of a scene change and the type of the frame by increasing a number of bits used to encode the image, without changing the frame type of the image.

31.   The system of claim 18, wherein the quantizer encodes the image in response to the determination of a scene change and the type of the frame by changing a quantization rate used to quantize the image, without changing the frame type of the image.

32.   The system of claim 18, wherein the quantizer encodes the image in response to the determination of a scene change and the type of the frame by temporarily increasing a counter of a number of bits available for encoding a remaining set of images in a group of images containing the uncompressed image.

33.   The system of claim 18, wherein the quantizer encodes the image in response to the determination of a scene change and the type of the frame by temporarily increasing a counter of a number of bits allocated to images having a same frame type as the frame type of the uncompressed image, in a group of images including the uncompressed image.

34.   The system of claim 18, wherein the scene change detector is further adapted, responsive to determining a scene change, to generate data identifying the uncompressed image as corresponding to a scene change, and storing the generated data in a side information file for transmission or storage.

35.   A computer program product, adapted to encode video images, comprising a computer readable medium containing computer executable instruction for performing the operations of:

    determining a macroblock type for each of a plurality of macroblocks in an uncompressed image;

    determining whether the image represents a scene change from a distribution of macroblock types of the macroblocks; and

    encoding the image in response to the determination of a scene change and the type of the frame.

36.   The computer program product of claim 35, wherein determining whether the image represents a scene change, comprises:

identifying the scene change in response to a percentage of prediction macroblocks in the image.

37.   The computer program product of claim 35, wherein determining whether the image represents a scene change, comprises:

responsive to the image being a forward predicted frame type, determining a percentage of intra-encoded macroblocks; and

responsive to the percentage of intra-encoded macroblocks, identifying a scene change at the image.

38.   The computer program product of claim 37, further comprising:

responsive to the percentage of intra-encoded macroblocks exceeding a threshold, identifying a scene change at the image.

39.   The computer program product of claim 38, wherein the threshold is about .65.

40.   The computer program product of claim 35, wherein determining whether the image represents a scene change, comprises:

responsive to the image being a bidirectionally predicted frame type, determining a percentage of backward predicted macroblocks; and

responsive to the percentage of backward predicted macroblocks, identifying a scene change at the image.

41.   The computer program product of claim 40, further comprising:

responsive to the percentage of backward predicted macroblocks exceeding a threshold, identifying a scene change at the image.

42.   The computer program product of claim 41, wherein the threshold is about .70.

43. The computer program product of claim 35, wherein determining whether the image represents a scene change, comprises:

responsive to the image being a bidirectionally predicted frame type, determining a percentage of forward predicted macroblocks; and

responsive to the percentage of forward predicted macroblocks, identifying a scene change at the image.

44. The computer program product of claim 43, further comprising:

responsive to the percentage of forward predicted macroblocks exceeding a threshold, identifying a scene change at the image.

45. The computer program product of claim 44, wherein the threshold is about .70.

46. The computer program product of claim 35, wherein determining whether the image represents a scene change, comprises:

responsive to the image being a forward predicted frame type, determining a percentage of intra-encoded macroblocks;

responsive to the image being a bidirectionally predicted frame type, determining a percentage of backward predicted macroblocks;

responsive to the image being a bidirectionally predicted frame type, determining a percentage of forward predicted macroblocks; and

responsive to the determined percentage exceeding a threshold corresponding to the type of macroblock, identifying the image as a scene change.

47. The computer program product of claim 35, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises increasing a number of bits used to encode the image, without changing the frame type of the image.

48.   The computer program product of claim 35, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises changing a quantization rate used to quantize the image, without changing the frame type of the image.

49.   The computer program product of claim 35, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises temporarily increasing a counter of a number of bits available for encoding a remaining set of images in a group of images containing the uncompressed image.

50.   The computer program product of claim 35, wherein encoding the image in response to the determination of a scene change and the type of the frame comprises temporarily increasing a counter of a number of bits allocated to images having a same frame type as the frame type of the uncompressed image, in a group of images including the uncompressed image.

51.   The computer program product of claim 35, further comprising:
responsive to determining a scene change, generating data identifying the uncompressed image as corresponding to a scene change, and storing the generated data in a side information file for transmission or storage.

52.   A computer system for encoding video images, each image having a frame type, comprising:
motion estimation means for receiving a plurality of macroblocks for an uncompressed video image and determining a macroblock type for each macroblock;
scene change detection means for determine whether the image represents a scene change from a distribution of macroblock types of the image macroblocks; and

encoding means for encoding the image in response to the determination of a scene change by the scene change detection means and the type of the frame.

53.   The system of claim 52, wherein the scene change detection means determines whether the image represents a scene change by:
   determining a percentage of intra-encoded macroblocks in response to the image being a forward predicted frame type;
   determining a percentage of backward predicted macroblocks in response to the image being a bidirectionally predicted frame type;
   determining a percentage of forward predicted macroblocks in response to the image being a bidirectionally predicted frame type; and
   responsive to a determined percentage exceeding a threshold corresponding to the type of macroblock, identifying the image as a scene change.

54.   The system of claim 52, wherein the encoding means encodes the image in response to the determination of a scene change and the type of the frame by increasing a number of bits used to encode the image, without changing the frame type of the image.

55.   The system of claim 52, wherein the encoding means encodes the image in response to the determination of a scene change and the type of the frame by changing a quantization rate used to quantize the image, without changing the frame type of the image.

56.   The system of claim 52, wherein the encoding means encodes the image in response to the determination of a scene change and the type of the frame by temporarily increasing a counter of a number of bits available for encoding a remaining set of images in a group of images containing the uncompressed image.

57.   The system of claim 52, wherein the encoding means encodes the image in response to the determination of a scene change and the type of the frame by temporarily increasing a counter of a number of bits allocated to images having a same frame type as the frame type of the uncompressed image, in a group of images including the uncompressed image.

58.   The system of claim 52, wherein the scene change detection means is further adapted, responsive to determining a scene change, to generate data identifying the uncompressed image as corresponding to a scene change, and storing the generated data in a side information file for transmission or storage.